

## Description

# WINDSHIELD LIQUID WASH HEATER

### BACKGROUND OF INVENTION

[0001] The invention relates to an improved windshield liquid wash heater and in particular to a relatively smaller, more efficient, and less costly to manufacture heater that incorporates a liquid wash line that is capable of rapidly heating the liquid wash contained therein.

[0002] By common winter experience of auto drivers much on the road, especially in the more northerly regions of the United States and Canada, frosting, icing or the like of the windshield is often an annoyance and not infrequently a definite driving hazard. Thus where a vehicle has been parked outside, freezing rain, sleet, or wet snow which has frozen, or at time heavy frost, may be deposited on a windshield which is not removable by windshield wiper action, may in fact have immobilized the blades, but in any event requiring scraping or chipping or application of chemical sprays, or a prolonged wait for the defrosters to melt or lessen the deposit, to clear at least the wiper-

swept area, before the vehicle can be safely driven.

[0003] Even under some warm weather driving conditions, hot wash water becomes highly desirable. Thus road oil or grime, especially on a recently wetted road, thrown against the windshield, can be cleaned in a second or two with heated liquid wash, whereas with unheated wash there may be several seconds of dangerously obscured vision. Also, vehicles parked under certain species of trees will accumulate a sap-like deposit which is not easily washed off by the usual auto windshield washers.

[0004] At times, even when a vehicle is being driven with the defrosters on at full heat and wipers operating, severe weather conditions may lead to some vision-obscuring icing, or there may be a small localized pad of ice or snow frozen onto a blade and spacing the rest of the blade from effective glass-wiping contact, so that vision is interfered with unless the driver stops to clean the blade. Usually under these circumstances the windshield washer system is of little help, since its liquid wash supply is itself comparatively cold and in any event would require undesirably extended use to be of any value.

[0005] To overcome such conditions, there have been under-the-hood apparatus or systems proposed to heat a suit-

able aqueous liquid by heat exchangers picking up heat either from the exhaust manifold or exhaust pipe, or from heated engine coolant, with the heated water then directed onto the windshield as needed.

[0006] The prior proposals have entailed various disadvantages. Some for example have by-passed or diverted exhaust gases through the heat exchanger, undesirable since interrupting the integrity of the poisonous exhaust gas conduits. Others have required connections into the engine block, the coolant hoses or inside heater hoses to furnish a heating medium to the wash water heater. Both types have had a degree of complexity in structure and/or in mounting which preferably is avoided or minimized.

[0007] One particular prior patent, U.S. Patent No. 3,785,359, disclosed an improvement over the prior art by disclosing a heater for windshield wash water which can be readily clamped and secured on an exhaust pipe or manifold to pick up waste heat. However, the device disclosed in U.S. Patent No. 3,785,359 is bulky, and takes approximately seven minutes to heat the wash water due to the size, shape and configuration of the wash water reservoirs contained therein, which is highly undesirable in today's fast paced world.

[0008] The present invention improves upon the general nature of the heater described in U.S. Patent No. 3,785,359 by providing a heater for the windshield liquid wash which is readily clamped and secured on an exhaust pipe or manifold to pick up waste heat, and which is simply connected into the windshield washer system. The improved heater comprises a housing, a thin-walled, relatively smaller diameter liquid wash line or tube contained therein and preferably at least partially encased in a filler material, and a pair of simple line connector fittings. Further the structure of the improved heater itself is quite simple, maintenance-free and of comparatively low cost involving only the improved heater and a simple clamping device.

#### **SUMMARY OF INVENTION**

[0009] The general objective of the present invention is to provide a simple, low cost, rugged, improved heater unit for rapidly heating a liquid by engine exhaust waste heat.

[0010] Another objective is to provide a simple windshield wash liquid heater readily installed in a vehicle such as an automobile.

[0011] Another objective is to provide a heater furnishing heated liquid wash for cleaning a windshield of icing in conjunction with wiper action over its area in a relatively short

time after engine starting.

[0012] These objectives and advantages are obtained by the improved windshield liquid wash heater of the present invention, the improved heater comprising a housing with a cavity contained therein, a thin-walled, relatively small diameter liquid wash line or tube contained in said cavity and preferably at least partially encompassed by a filler material, and a pair of simple line connector fittings.

#### **BRIEF DESCRIPTION OF DRAWINGS**

[0013] The preferred embodiment of the invention, illustrative of the best mode in which applicant has contemplated applying the principals is set forth in the following description and is shown in the drawings and is particularly and distinctly pointed out and set forth in the appended claims.

[0014] FIG. 1 is a schematic diagram of a heater installation in a windshield wiper wash water system with a portion of the liquid wash tank broken away to reveal the liquid wash;

[0015] FIG. 2 is a perspective view of the improved heater unit mounted on a fragmentarily shown engine exhaust pipe and including a hidden view of the liquid wash tube;

[0016] FIG. 3 is a cross-section view of the improved heater of FIGS. 1 and 2 and mounted to an exhaust pipe;

- [0017] FIG. 4 is an exploded view of the improved heater unit of FIGS. 1–3 and depicts the housing, the thin-walled, relatively small diameter liquid wash tube, and a clamp.
- [0018] FIG. 5 is a perspective view of the improved heater of FIG. 2 and showing a portion of the housing broken away to reveal the liquid wash tube and the space not consumed by the liquid wash tube being filled with a filler material;
- [0019] FIG. 6 is a perspective view of an alternative embodiment of the improved heater unit shown in FIG. 2, with an alternative orientation of the liquid wash tube and the connector fittings located on opposite ends of the housing; and
- [0020] FIG. 7 is an exploded view of an alternative embodiment of the improved heater unit shown in FIG. 4, with a double serpentine liquid wash tube.

#### **DETAILED DESCRIPTION**

- [0021] In the drawings, FIG. 1 schematically represents use of heater unit 10 of the present invention as hereinafter described in an automotive vehicle environment, namely in a windshield washer system, wherein the washer jets 12 are supplied with heated liquid wash, such as water in combination with other freezing point depressants or any other commercially available windshield wash fluid, through pump output lines 14 and 16 by pump 18 with intake

connected by pump intake line 20, the heater 10 and heater inlet line 22 to the liquid wash supply vessel 24 and liquid wash 25. Heater 10 is held in thermally conductive contact and heat transferring proximity with the engine exhaust manifold or the exhaust pipe 26 to warm the liquid wash passing there through.

[0022] Heater 10, in general form, is symmetrical about a longitudinal center plane having a longitudinally straight transversely concave bottom recess 30a and a hemispherical top 30b connected by sides 30c; providing top and side surfaces well adapted for band clamping on the cylindrical pipe exterior as shown in FIG. 2, by even a simple bolt-tightened clamp strap 32 or any other suitable banding clamp, with the opposed band ends at 34a and 34b bolted on or near one or both of sides 30c. Notwithstanding the foregoing, it is understood that the use of clamp 32 to attach heater 10 to the exhaust pipe or manifold is not crucial to achieve the advantages of the present invention, and that any suitable means of attaching heater unit 10 to the exhaust pipe or manifold or anywhere else along the exhaust system can be used without affecting the overall concept of the present invention.

[0023] Heater 10 further comprises a housing 30 having a cavity

contained therein, a nonlinear, preferably serpentine or curvilinear liquid wash tube 40 at least partially contained therein, optional filler material 50 which is preferably heat-conductive, and connector fittings 61 and 62. Housing 30 is preferably a steel casting, though it is contemplated that housing 30 could be formed of any type of durable material without affecting the overall concept of the present invention. Housing 30 functions as both a heat sink, by absorbing waste heat from its close proximity to the engine exhaust manifold or exhaust pipe 26, and to house and protect liquid wash tube 40.

[0024] The convexity of the recess 30a may amount to almost a full semi-cylinder; and where exhaust pipe 26 has the same curvature a rather extended heater-to-pipe contact surface area is then obtained. However, even where the pipe radius is say smaller, so that theoretically a line contact would result, practically a more than line contact arises and the proximity still offers further good heat transfer by radiation and air convection to the extent that one heater size may usefully be applied even to a range of pipes.

[0025] In accordance with another important feature of the present invention, liquid wash tube 40 has two ends and



is preferably formed of thin-walled, relatively small diameter copper tubing, though it is contemplated that any type of tubing, either rigid or flexible, capable of conducting heat and accommodating the flow of liquid wash 25 therein can be used without affecting the overall concept of the present invention. For example, it is also contemplated that a braided polymer material could be used over a thermoset tube, or the braiding itself can be a thermoset plastic.

[0026] The diameter of wash tube 40 is preferably less than one inch, but it is contemplated that larger diameter lines or tubes will also achieve the stated advantages of the present invention. Liquid wash tube 40 is preferably orientated within housing 30 in a serpentine configuration as illustrated in FIG. 2, though alternative orientations of liquid wash tube 40 are also contemplated, and indeed two such alternative orientations are illustrated in FIGS. 6 and 7, respectively. In fact, FIG. 7 illustrates a double serpentine orientation, which could easily be applied to the embodiment shown in FIG. 2 without effecting the overall concept of the present invention. The serpentine or other non-linear or curvilinear configuration of liquid wash tube 40 allows for increased liquid wash capacity and residence

time for liquid wash 25 within housing 30 and in close proximity to exhaust pipe 26, which ensures that an adequate supply of heated liquid wash is available on demand. The thin-walled, relatively small-diameter construction of liquid wash tube 40 and its close proximity to exhaust pipe 26 enables heater unit 10 to heat liquid wash 25 quickly and efficiently, and is an improvement over the two much larger reservoirs, connected in series, disclosed in U.S. Patent No. 3,785,359, which takes much longer to heat due to the thickness and orientation of the reservoirs.

[0027] Preferably, liquid wash tube 40 is at least partially encompassed within housing 30 by optional filler material 50. In a preferred manner of construction of improved heater 10, liquid wash tube 40 is inserted into the cavity of housing 30 and filler material 50 is poured into housing 10 to at least partially encompass liquid wash tube 40, as shown in FIG. 5. Filler material 50 is then permitted to harden, thereby holding liquid wash line securely within housing 30, and preventing or minimizing any vibration of the liquid wash tube within housing 30, which is undesirable if left unabated. Filler material 50 can be any type of material, such as, without limitation, epoxy cement, liquid

ceramic, sand, clay, or any other material that is capable of withstanding the heat associated with its close proximity to exhaust pipe 26.

[0028] In accordance with yet another important feature of the present invention, one of connector fittings 61 and 62 is fixedly attached to each end of liquid wash tube 40 and extend outwardly from housing 30 as illustrated in FIG. 2. Notwithstanding, it is contemplated that connector fittings 61, 62 could also be orientated on opposite ends of heater unit 10 as illustrated in FIG. 6, on top of housing 30 or in any other configuration without affecting the overall concept of the present invention.

[0029] Preferably, the outer ends of connector fittings 61, 62 afford circumferentially ribbed nipples adapted to accept and hold thereon the ends of the elastomeric tubing used in the typical auto windshield washer system for pump intake line 20 and heater inlet line 22 between liquid supply vessel 24 and pump 18, though it is contemplated that any other attachment means, such as a band clamp, could also be used to connect intake line 20 and heater inlet line 22 to the opposite ends of liquid wash tube 40. It is also contemplated that connector fittings 61, 62 can be of the "quick connect" variety without affecting the overall con-

cept of the invention.

[0030] Having described the structure of the improved heater of the present invention, the operation of heater 10 will now be described. Upon activation of the vehicle engine (not shown) high temperature exhaust is forced through exhaust manifold (not shown) and exhaust pipe 26 thereby transferring heat to housing 30, optional filler material 50 and to liquid wash tube 40 and the liquid wash contained therein. The heat conductive nature of housing 30 and liquid wash tube 40 as previously described, coupled with the thin-walled, relatively small diameter configuration of liquid wash tube 40 results in almost instantaneously heated liquid wash within heater unit 10.

[0031] To supply the heated liquid wash to the windshield, the operator of the vehicle simply activates the liquid wash component of the vehicle's windshield system (not shown) from inside the vehicle which in turn causes pump 18 to draw the heated liquid wash from heater unit 10 through pump inlet line 20, pump outlet lines 14 and 16 and apply it to the windshield via jets 12. As yet another important feature of the present invention, as the heated liquid wash is drawn out of heater unit 10 and applied to the windshield, additional liquid wash is drawn into liquid wash

tube 40 by pump 18 and heated, thereby assuring a continuous supply of available heated liquid wash.

[0032] The improved heater unit 10 of the present invention can be used with virtually any windshield washer system whereby hot liquid wash is desired. Heater unit 10 also is relatively economical to manufacture, use and maintain.

[0033] Accordingly, the heater unit of the present invention is simplified, provides an effective, safe, inexpensive and reliable apparatus for heating liquid wash which achieves all of the enumerated objectives, provides for eliminating difficulties encountered with prior liquid wash heaters, and solves problems and obtains new results in the art.

[0034] In the foregoing description, certain terms have been used for brevity, clearness and understanding; but no unnecessary limitations are to be implied therefrom beyond the requirements of the prior art, because such terms are used for descriptive purposes and are inferred to be broadly construed.

[0035] Moreover, the description and illustration of the invention is by way of example, and the scope of the invention is not limited to the exact details shown or described.

[0036] Having now described the features, discoveries and principles of the invention, the manner in which the improved

heater unit is constructed, arranged and used, the characteristics of the construction, arrangement and method steps, and the advantageous, new and useful results obtained; the new and useful structures, devices, elements, arrangements, parts and combinations are set forth in the appended claims.